IS 11052 (1984): Methods of test for vertical impact drop test on paper sacks [CHD 15: Paper and its products]

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Indian Standard

METHODS OF TEST FOR VERTICAL IMPACT DROP TEST ON PAPER SACKS

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METHODS OF TEST FOR VERTICAL IMPACT DROP TEST ON PAPER SACKS

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Indian Standard

METHODS OF TEST FOR VERTICAL IMPACT DROP TEST ON PAPER SACKS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 March 1984, after the draft finalized by the Paper and Flexible Packaging Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 Vertical impact drop test is performed to investigate the effect of vertical impact or as part of a sequence of tests designed to assess the ability of a sack to withstand a distribution system that includes a vertical impact hazard. This standard is based on IS : 7028 (Part 4)-1973* but is specifically related to paper sacks.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies methods of performing a vertical drop impact test on a filled paper sack by dropping.

1.1.1 This standard specifies the test procedure and how the test reports should be presented.

2. PRINCIPLE

2.1 The filled sack is raised above a rigid plane surface and released to strike this surface after a free fall, the atmospheric conditions, the height of drop and the position of the package being predetermined.

3. APPARATUS

3.1 A lifting arrangement, which shall not damage the sack during either lifting or release.

*Performance tests for complete, filled transport packages: Part 4 Vertical impact drop test.

†Rules for rounding off numerical values (*revised*).

3.2 A means of holding the sack prior to release in its predetermined position.

NOTE — The difference in behaviour of a sack suspended from the top or supported underneath in a butt drop could be significant and the method of holding the sack before dropping shall be included in the test report.

3.3 A release mechanism, to release the sack in such a way that its fall is not obstructed by any part of the apparatus before striking the impact surface.

3.4 An impact surface, horizontal and flat, massive enough to be immovable and rigid enough to be non-deformable under test conditions. In normal circumstances the impact surface provided shall be:

a) Integral with a mass at least 50 times that of the heaviest sack to be tested;

b) Flat, such that no two points on its surface differ in level by more than 2 mm;

c) Rigid, such that it will not be deformed by more than 0·1 mm when an area of 100 mm^2 is loaded statically with 10 kg load anywhere on the surface; and

d) Sufficiently large to ensure that the sack falls entirely upon the surface.

A plastic film may be used on the impact surface under the sack in order not to damage the sack while moving it.

Examples of types of apparatus that may be used are shown in Fig. 1 and 2.

4. SAMPLING

4.1 Sampling shall be carried out in accordance with the procedure laid down in IS : 10528-1983*.

5. CONDITIONING

5.1 The empty sacks shall be conditioned to a temperature of $27\pm2°C$ and RH 65 ± 2 percent until equilibrium is reached, approaching such equilibrium from dry side [*see* IS : 1060 (Part 1)-1966†].

6. PROCEDURE

6.1 The test shall be carried out in the same atmospheric conditions as used for conditioning or, if not, the test shall commence within 3 minutes of removing the sack from the conditioning atmosphere.

*Method of sampling empty paper sacks for testing.

†Methods of sampling and test for paper and allied products: Part 1 (*revised*).

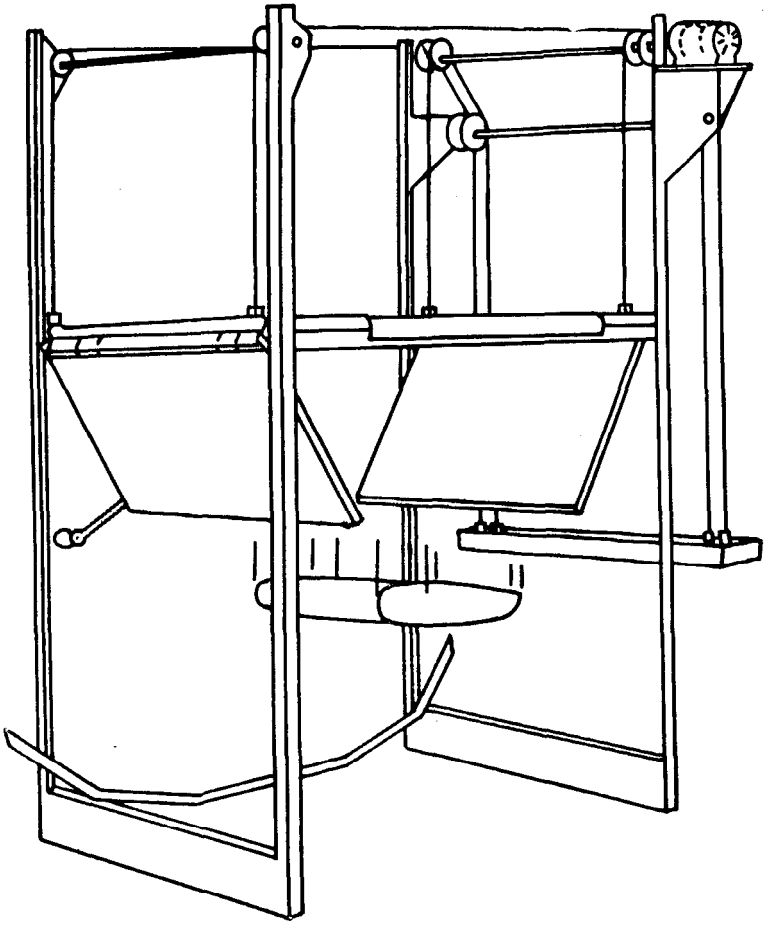

FIG. 1 TYPICAL APPARATUS FOR FLAT AND SIDE DROPPING OF SACKS

6.2 Filling — The sacks shall be filled with the intended commodity but, if this is not possible, with a similar material, taking into account type and size of granules, etc, to give the same degree of filling. The mass of filling material shall be within ± 0·2 percent of that of the nominal mass of the intended contents of the sack. All air pockets in the sack shall be removed as far as possible before closing or stitching the sack finally before testing. The material in the sack shall be positioned on the trap door before the drop.

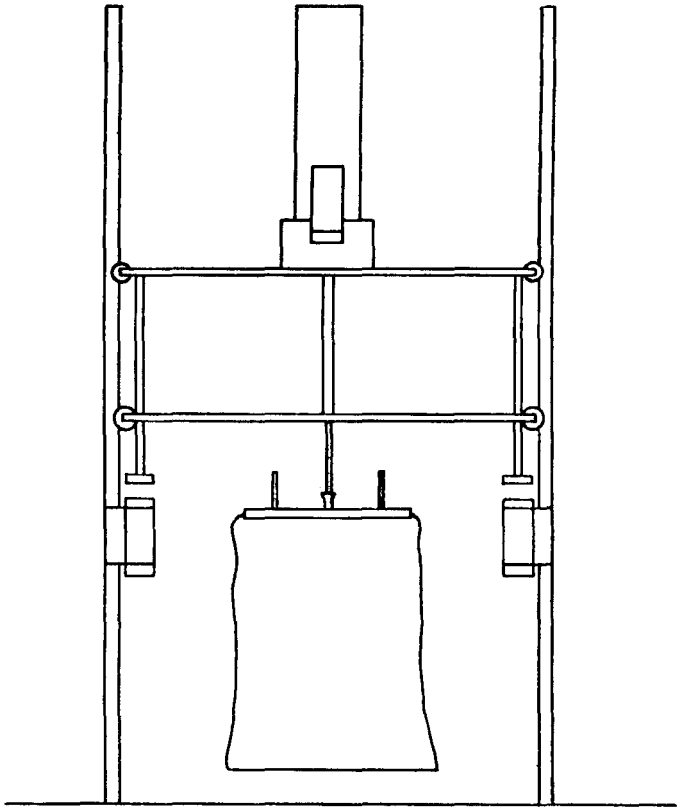

FIG. 2 TYPICAL APPARATUS FOR BUTT DROPPING OF SACKS

6.3 Dropping — The sack under test shall be positioned centrally on the platform which is then raised to a height that is within ± 2 percent of the predetermined drop height as defined by the distance between the lowest point on the sack at the time of release and the nearest point on the impact surface.

6.4 The sack shall be released from its predetermined position within the following tolerances:

a) For drops on any side or edge: there shall be a variation of no more than 2° between the impacting surface and the horizontal surface.

b) For edge or corner drops : the angle between a prescribed surface of the sack and the horizontal surface shall be 45 ± 5°.

c) The velocity at impact shall be within ± 1 percent of that which would be achieved by a free fall.

6.4.1 *Dropping Procedures* — The nomenclature used in this section to refer to the various surfaces of the filled sack is set down in Appendix A.

6.4.1.1 *Flat dropping* — Successive sacks shall be dropped alternately on the front side (1) and on the back side (3), so that the first sack is dropped on the front side until it breaks and the second on the back side until it breaks, and so on.

6.4.1.2 *Side dropping* — Successive sacks shall be dropped alternately on the side (2) and the side (4), so that the first sack is dropped on the side (2) until it breaks and the second on the side (4) until it breaks, and so on.

6.4.1.3 *Butt dropping* — The sack shall be dropped only on the bottom (5) until it breaks.

6.4.1.4 *Edge and corner dropping* — If this test is necessary, the sack shall be dropped on any corner or any edge until it breaks.

6.5 Test Methods

6.5.1 *Progressive Drop Height Method* — This method may be used for flat and butt drop testing of paper sacks.

6.5.1.1 *Flat and side drop test*

Drop height formula:

$$h = 0{\cdot}85 + 0{\cdot}15\ (n-1)$$

where

h = drop height in metres, and

n = drop number.

The drop test shall be initiated at 0·85 m height. After each drop without any visible failure on the sack, an increment of 0·15 m in drop height shall be made.

A sack shall be considered broken when spillage of the contents occurs. The final drop height at break is recorded.

The test result shall be reported as the average breaking height (h) and the corresponding number of drops (n).

6.5.1.2 *Butt drop test*

Drop height formula:

$$h = 0{\cdot}30 + 0{\cdot}05\ (n-1)$$

where

h = drop height in metres,

n = drop number.

The drop test shall be initiated at 0·30 m height.

After each drop without any visible failure on the sack, an increment of 0·05 m in drop height is made,

The result shall be reported in accordance with **6.5.1.1**.

NOTE — For sacks of composite materials or with reinforcement of any type, a suitable initial drop height may be selected with increments of about 1/6 of the initial height, rounded to the nearest 0·05 m.

6.5.2 *Constant Drop Height Method* — This method may be for testing of ordinary paper sacks as an alternative method to the progressive drop height method.

6.5.2.1 *Flat, side or butt drop test* — This test may be used for either flat side or butt dropping and shall be performed from a constant height so selected that the number of drops before rupture is about 10.

A sack shall be considered broken when a spillage of the contents occurs.

The report shall give the drop height, number of drops to breakage and the type of drops (that is, flat, side or butt drops).

NOTE — The constant drop height method has a special application when testing paper sacks intended for the transport of dangerous goods (maximum net mass 50 kg). According to UN Recommendations and the IMDG Code, three sacks shall be sampled and tested. In the UN Recommendations, paper sacks intended to convey goods presenting medium danger (Packaging Group II) shall be dropped from a height of 1·2 m. While those presenting minor danger (Packaging Group III) shall be dropped from a height of 0·8 m. It is required that each of the filled sacks shall be dropped once on the front side and once on the bottom from the prescribed height. With both levels of testing there shall be neither serious rupture to any of the sacks nor loss of contents.

6.5.3 *Limit Height Method* — This method shall be used to test sacks with higher strength than ordinary paper sacks.

6.5.3.1 *Flat, side or butt drop test* — The test may be performed as flat, side or butt drop test.

In this test the lowest height at which the sack will break on the first drop is claculated from the result obtained.

The sack shall be dropped from three constant heights, which give mean drop numbers of approximately 3, 8 and 13.

The limit height (H) is calculated from the formula:

$$n = \left(\frac{H}{h}\right)^a$$

where

n = mean drop number.

H = limit height,

h = drop height, and

a = constant to one sack grade.

H may also be calculated using a graphical method, by plotting the mean drop number (n) against the corresponding drop height (h) on log-log graph paper as shown in the example (*see* Fig. 3).

The test report shall give the drop heights used, number of drops to breakage at each height and the type of drops (that is, flat, side or butt drop).

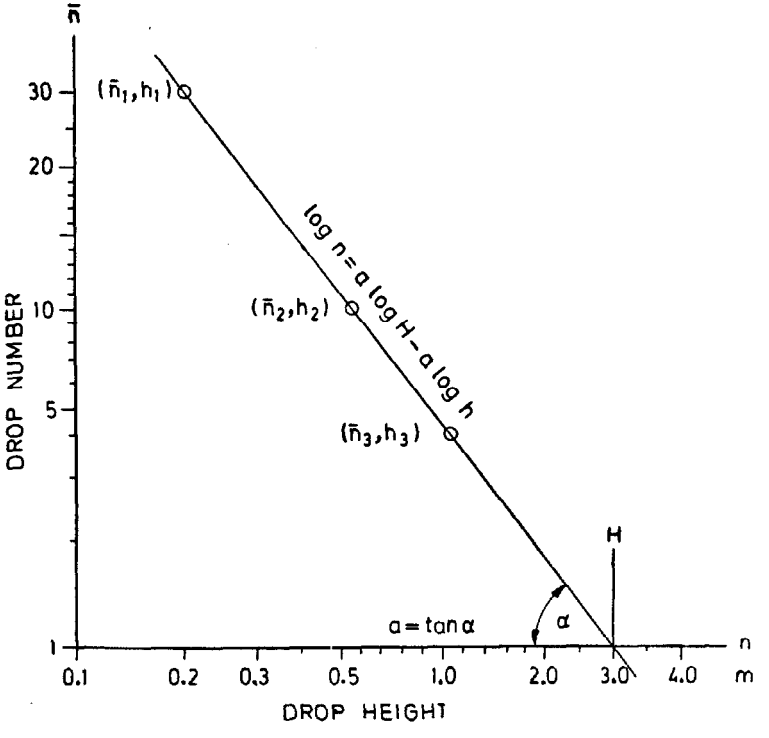

FIG. 3 GRAPHICAL METHOD FOR CALCULATION OF LIMIT HEIGHT, H

7. TEST REPORT

7.1 The test report shall include full details of size, construction and type of all sacks tested together with information on the type and mass of contents and mode of closure.

7.2 All results shall be given and shall include details of position and type of failures.

7.3 A suitable format for a report form that may be used for this purpose is given in Appendix B.

APPENDIX A

(*Clause* 6.4.1)

IDENTIFICATION OF SURFACES OF FILLED SACKS FOR TESTING

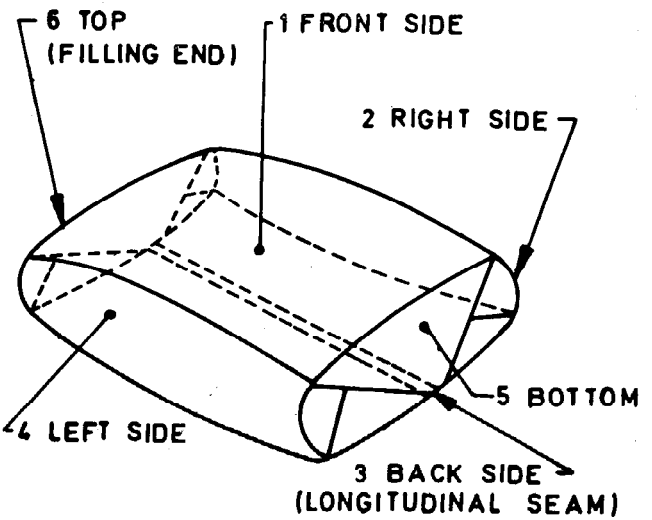

FIG. 4. IDENTIFICATION OF SURFACES

The sack shall be placed on the back side (3) (that is, that, side containing the longitudinal seam) downwards, and the top (that is, the filling end) (6) of the sack positioned away from the observer, as shown in Fig. 4 above.

The different surfaces are identified as:

Surface 1	Front side
Surface 2	Right side
Surface 3	Back side (longitudinal seam)
Surface 4	Left side
Surface 5	Bottom
Surface 6	Top (filling end)

APPENDIX B

(*Clause* 7.3)

DROP TEST REPORT

Sack and Test Details

Manufacturer:	Sack Type:	Test Purpose:
Manufacturing No. :	Dimensions:	Test Method:
Manufacturing Date:	Specification:	Conditioning:
Order No. :		Filling Material:
Customer:	Date of Test:	Filling Weight:

Drop Test Results

Drop No.	h cm	Sack No.														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1																
2																
3																
4																
5																
6																
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Remarks:

Signature:

Date: